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THE RAINFALL OF JUNE.

It is necessary every now and again to call the attention of our readers to the last five pages of this Magazine, for they contain the earliest systematic information regarding the rainfall of the month which is presented to the public, and as they sometimes are not completed when the proofs are passed (for the telephone enables the Editor to catch the printer with corrections up to the very moment of going to press) it is not always easy to call attention in the letter-press to the facts set out in figures. The first two columns of p. 129 show that every station except two had falls of rain exceeding their average for June, and that at 18, out of the 55 stations quoted, more than twice the average fell, and at one, Cardiff, the rainfall was almost three times the average. These are interesting, though by no means very extraordinary, figures, for there is rarely a year without some months equally wet. The feature of a wet summer month is usually the irregularity of the heavy falls, and our map of the rainfall of the Thames Valley (facing p. 114) shows that in that area it varied from less than 2 inches in the east of Essex, where the amount was just the average, to more than 5 inches in the extreme south-west and north-west, the latter containing a small area with more than 6 inches between Stroud and Evesham. The irregularity of the isohyetals shows the effect of numerous thunderstorms affecting various localities.

The map of the rainfall of the British Isles, which we regret not to publish, shows that, with the exception of Essex, the only place with less than 2 inches of rain in June was a narrow strip of the east coast of Scotland north of Arbroath, and the north-east of Caithness where the rainfall was under 1 inch and less than half the average amount. Large areas in the west and south-west of Scotland received more than 6 inches of rain, and there were patches with more than 6 inches in the north of England, in north and south Wales and over the greater part of Cornwall and Devon. The west of Ireland also had more than 6 inches, and only a small area round Dublin had less than 3 inches.

The stations quoted in the Table are so uniformly distributed that the mean gives a fair approximation to the general rainfall, and dealing thus with the percentage of the average we find that (the local average for June being 100 in each case) England and Wales had 186, Scotland 156, Ireland 193, and the British Isles as a whole 180.

THE WEATHER OF JUNE.

By FRED. J. BRODIE.

IN the third week of June the country lying to the eastward of a line drawn from the Wash to the Isle of Wight experienced four or five days of brilliant summer weather. The highest temperatures of this period, and in fact of the whole month, were recorded at some stations on the 19th, and at others on the 22nd. On one or other of these occasions, and locally on each of them, the thermometer in the shade rose to 80°, or a little beyond it in many places, a reading of 84° being registered at Greenwich, and a reading of 83° at Hampstead and Camden Square. With the exception of this one fine spell in the south-east the weather of last month was of a continuously broken character, the number of days with rain being everywhere largely in excess of the normal. At the majority of stations in the western parts of the United Kingdom, and also at several places in the north, the total precipitation was equal to more than twice as much as the average. Thunderstorms were unusually frequent, and were accompanied in some instances by torrential falls of rain and hail.

The generally unsettled character of the weather was due to the almost constant extension over these islands of large cyclonic systems from the Atlantic. In the earlier half of the month the centres of the disturbances passed in many instances directly across the United Kingdom, and as a result the winds in the north were mainly from polar quarters, while those in the south blew more commonly from points between south and west. The depressions were as a rule too shallow to occasion anything beyond the force of a fresh breeze, but on the 4th, when a complex disturbance, with two distinct minima, passed eastward across the country, the wind blew very strongly from N.E. in Scotland, and from S.W. in the English Channel; while on the 15th, when a deep depression was developed over Scandinavia, the north-westerly current increased greatly over England, and reached the force of a gale in the North Sea. The lowest temperatures of the month were registered between the 3rd and 5th, when the sheltered thermometer fell below 40° in many parts of the country, and below 35° at some of the central stations in Ireland and Scotland; at Balmoral a reading of 32° was recorded early on the 4th. On the surface of the grass slight frost occurred at about the same time in a few scattered places, and as far south as Greenwich, but the cold snap was not sufficienely serious to cause any material injury to vegetation.

In the latter half of the month the central areas of the Atlantic low pressure systems passed along in a northerly or north-easterly course, well outside our western and northern coasts. Winds from the southward or south-westward were consequently experienced over the country generally, and temperature was higher than in the first

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Watershed of River Thames above Teddington, and River Lee above Feildes Weir. ——

Rainfall Stations reporting ------ •

Isohyetals. — — —

fortnight, though mostly below the average. On the 17th the sheltered thermometer fell slightly below 40° at many places in the west and north, and touched 35° at Balmoral. On the 25th, when the centre of one of the large Atlantic disturbances passed across Scotland, the wind in the Channel increased to the force of a gale.

In London the total duration of bright sunshine was in excess of the normal, Westminster recording an aggregate of 195 hours, as against an average of 167 hours. Over the country generally there was, however, a deficiency of this very important element, and at many places in the west and north the deficiency was very large. At Aberdeen the total duration was less than 82 hours, being considerably less than half of the average, and by far the lowest observed in June since the record commenced in 1881. Owing to the prevalence of so much cloud the mean temperature of the month nearly everywhere was below the normal, but above it at a few places in the east of England. In some parts of London the deficit, though slight, was sufficient to break the marvellous record of undue warmth which had prevailed throughout nearly the whole of the previous 13 months [but see p. 131, first paragraph].

INTERNATIONAL BALLOON ASCENTS.

By W. H. Dines, F.R.S.

January, 1910.

Starting Point	Country.	A miles.	B ° F.	C miles.	D ° F.	E miles.	F
Manchester....	England	7·5	—82	11·3	—77	59	N.E.
Petersfield	,, ...	..	..	7·2	—77	20	N.N.E.
Brussels	Belgium	8·1	—96	14·1	—75	127	S.
Hamburg.....	Germany....	7·4	—87	9·9	—73	75	S. by W
Lindenberg....	,, ...	6·7	—75	9·9	—73	67	S.S.W.
Strassburg	,, ...	7·5	—84	10·3	—74	90	S. by W.
Pavlovsk	Russia	5·9	—71	9·9	—74	165	S. by W.

A Height in miles of commencement of isothermal column.
B Temperature, F°., at bottom of column.
C Greatest height of reliable record in miles.
D Temperature, F°., at greatest height.
E Distance in miles of point where balloon fell.
F Bearing of falling point from starting point.

An extensive region of high pressure lay over the whole area, with lower pressure over the North Atlantic and South Russia. The figures show that the commencement of the isothermal column was higher than usual, as is generally the case when the pressure is high. The temperature over Belgium, —96°, is very low, and there is a remarkable uniformity, —73° to —77° at the highest points, which must be partly a chance result.

ROYAL METEOROLOGICAL SOCIETY.

THE last meeting of the Session was held at the Society's rooms, 70, Victoria Street, Westminster, on Wednesday afternoon, June 19th, Dr. H. N. Dickson, President, in the chair.

Dr. G. C. Simpson, Meteorologist to the British Antarctic Expedition, 1910, who had just returned to this country, read a paper on "Coronæ and Iridescent Clouds." In September, 1911, he was one of a party led by Captain Scott to survey McMurdo Sound, and on the 24th of that month, while the party was sledging on sea ice, they became enveloped in fog. During the afternoon the sun began to shine through the fog, and suddenly they saw in front of them a fine fog-bow. It was opposite the sun, and a measurement of the radius with a theodolite gave 38°. The bow was practically white, but a reddish tinge could be seen on the outer side. As the fog dissipated the upper sky became clearer and the sun shone over the top of a heavy bank of fog. For some minutes the sun had a brilliant corona with bright colours, and the diameter of this corona seemed unusually large, but there was no opportunity to make a measurement. As the fog still further cleared away glimpses of the corona appeared again, and the fog under the sun became fairly brilliantly illuminated with iridescent colours, which did not appear to be part of the corona but in places blended into it. During the whole period the temperature was between —15° and —21° F. The fur of the sleeping bags and the wool of sweaters became covered with hoar frost. These observations show that water can exist in the atmosphere in liquid drops at much lower temperatures than has generally been supposed by meteorologists. It is now generally admitted that while halos are caused by refraction and reflexion of ice crystals, coronæ are due to diffraction effects of either small drops of water or thin ice needles. From certain observations made in the Antarctic, Dr. Simpson was led to doubt the possibility of ice crystals ever producing diffraction effects. This is an important question for meteorology, for if it is true we have a powerful instrument for determining the constitution of a cloud; if there is a corona the cloud must be composed of water drops, while if there is a halo it must be composed of ice crystals.

An interesting discussion followed the reading of this paper, in which Captain D. Wilson-Barker, Dr. H. R. Mill (who suggested that optical effects alone should not be taken as positive proof of the existence of liquid water 50° below the freezing point), Dr. W. N. Shaw (who considered that it was not unreasonable to expect to find liquid water in the atmosphere at very low temperatures), Mr. W. W. Bryant, Mr. R. Inwards, Mr. R. Strachan, and the President, took part, and Dr. Simpson replied.

Mr. W. W. Bryant read a paper on "The Adoption of a Climatological Day." When observations are made only once a day, viz., at 9 a.m., it is the practice to enter the reading of the maximum

thermometer to the previous day, and the reading of the minimum thermometer to the current day. Mr. Bryant does not consider that these give correct results, but that they are higher than if the readings were taken at 9 p.m., or midnight, and applied to the civil day.

Mr. J. Baxendell sent a note in which he referred to a similar comparison made by Mr. W. Ellis many years ago, who found that the mean monthly maximum and minimum temperatures derived from the climatological (or 9 a.m.) system of observing only differ from Second Order (or 9 p.m.) ones, on the average, by some few hundredths (not tenths) of a degree. Mr. Baxendell added that at Southport, where the climate is totally different from that at Greenwich, the case is the same, the average difference being only 0°·1

Mr. R. G. K. Lempfert also sent a note with reference to the method adopted at the various stations of the Meteorological Office, and the following took part in the discussion:—Dr. W. N. Shaw, Mr. E. Gold, and Mr. J. Hopkinson, and Mr. Bryant replied.

The following gentlemen were elected Fellows of the Society:—Mr. A. J. Bamford, F.R.A.S., Capt. G. Byers, Mr. G. W. Cox, and Dr. W. A. Spence.

EARLY REFERENCE TO RAINFALL.

We have so frequently to assure the representatives of newspapers that we have no data for foretelling the rainfall of the coming week-end, month or season, that we have been strongly impressed with the human craving for knowledge of the future in this respect. It seems to be an immemorial craving of humanity to seek for signs and portents of the coming of rain, and the following note from *The Times* of 10th July, 1912, carries us very far back:—

The British Museum has acquired a collection of animal bones inscribed with archaic Chinese characters of a more primitive type than any yet found, even on the ancient bronzes. These bones were purchased some months ago by the authorities of the Museum. Owing to their extreme antiquity the characters have been deciphered only in part. Many of them, indeed, are far more primitive than any characters yet identified. It is clear, however, that these writings are the records or notes of inquiries made mostly by the king. The bones, having been inscribed with questions, were seared with hot irons, and the cracks which then appeared in the bones were interpreted according to certain rules of divination. The process of interrogation was carried out by professional diviners. The inquiries relate to such things as the prospects of rainfall, harvests, the fate of prisoners, hunting expeditions, change of residence, and so forth. One eminent authority inclines to assign the date of the inscriptions to the middle and the early part of the Chou dynasty, which lasted from B.C. 1122 to B.C. 249; but two modern Chinese critics attribute them to the Shang dynasty, which lasted from B.C. 1766 to B.C. 1122. In any case they are the oldest forms of Chinese writing that have survived.

THE DISSEMINATION OF WEATHER FORECASTS.

By H. E. CARTER.

FOR some time past there have appeared at intervals in the pages of *The Surveyor* letters regarding the effect of the weather upon the work of municipal and sanitary engineers. The keynote of the correspondence has been a plea for a wider and more efficient distribution of weather forecasts from the Forecast Branch of the Meteorological Office, and such support was given to the proposal that a deputation representing a large number of municipal bodies waited upon Dr. W. N. Shaw and urged upon him the importance of their views.

Mr. Harold G. Turner, assistant engineer and surveyor of Surbiton, was, we believe, the pioneer in this movement, and his proposal was that the daily reports and forecasts of the Meteorological Office should be supplied direct to municipal engineers, and through them to the public. Mr. Turner's suggestion was at once approved by the following engineers and surveyors:—Messrs. G. Bruce Tomes, C.E. (Barnes), A. B. Lismer, C.E. (Edmonton), H. C. Fread, A.R.I.B.A. (Esher and the Dittons), S. H. Chambers (Hampton), R. H. Jeffes, C.E. (Maldens and Coombe), G. Jerram, C.E. (Merton), H. T. Mather (Surbiton), and M. Hainsworth (Teddington). Dr. Shaw, in replying to the suggestion, recognised that trustworthy information as to future weather changes was of great service to municipal engineers. The distribution of forecasts through the press involves unavoidable delay, and direct distribution by telegram would be much more satisfactory. He continued: "The authorisation to exhibit harvest forecasts in post offices is a first step in this direction, but under present circumstances the cost of transmission of the telegrams has to be borne locally. I understand that in Germany and Denmark forecasts are transmitted regularly to all post offices or railway stations and there publicly exhibited. I believe that a similar arrangement in this country would soon develop into an important public service, and I, therefore, welcome suggestions from outside which show that there is a demand for such information. Without a public demand I cannot expect the organization which the scheme would require to be forthcoming."

The matter at once appealed to a large number of municipal engineers, and Mr. Reginald Ryves contributed a lengthy statement, setting forth the arguments in favour of such a scheme, which he regarded as a large economic gain to the country as a whole. He drew attention to the disadvantages of occasional forecasts, and said, concerning the financial position:—"An annual expenditure of £10,000 would allow of telegrams being sent to about 2,000 post offices daily, supposing the post office to charge 3d. each, which should be a liberal allowance for telegrams sent in a short, simple and easily used code. If the reader would take the trouble to mark down the share of these for any part of the country he will find that the

telegrams would be brought within a few miles of almost every spot, and could be brought within a very short distance indeed of the greater part of the population. As, however, farmers and small holders are the classes that benefit most from such telegrams, it is well not to lay stress upon the latter fact, but rather to make the smallest maximum distances the measure of the efficiency of the distribution. If we allow 5,000 stations for Ireland, Scotland and Wales, we are left with 5,000 for England. Taking, as an example, Staffordshire, which has an area of about one-twelfth that of England, and includes agricultural, pastoral, moorland and industrial areas, the allowance of 400 stations is ample, for it will be found that 350 stations command all parts of it with a maximum distance of about 3 miles. The distance is, of course, increased slightly in some parts, owing to the positions of the post offices, but there are so many ways in which the daily forecast would be passed on from mouth to mouth, that this would not be a serious matter."

A regular use of the forecasts would certainly considerably reduce the losses now incurred without their aid. The agricultural community has long since realised the value of the special "harvest forecasts" prepared for their use, and the storm warnings have proved of enormous value to the mariner. The highway engineer and district surveyor would benefit considerably, especially as regards such public work as watering, sweeping, scraping and brushing the roads, the removal of snow, and the construction and maintenance of the public highways. A weather forecast available at, say, 4.30 p.m., and covering the ensuing 24 hours, would permit of to-morrow's work being arranged over-night, with due regard to the probable state of the weather. The value of the forecast is ever increasing as the percentage of successful forecasts has, during recent years, shown a gratifying advancement. In 1909 and 1910 the percentage of complete and partial successes reached 93.

The energies of the pioneers in this movement, the work of the local Forecast Committees, and the publicity given to the matter in *The Surveyor*, resulted in the subject being discussed by Urban Councils and various Highways Committees in all parts of the country. In almost all cases these bodies offered to co-operate in the effort to secure the benefits which the better dissemination of weather forecasts would bring. The Council of the Royal Sanitary Institute passed a resolution in support of the proposition, but added a suggestion that an endeavour should be made to arrange for additional observations so that the Meteorological Office may be able to reduce the size of the areas for which the forecasts are now given.

Mr. Frank Turner, engineer and surveyor to the Tonbridge Rural District Council, did not hesitate to say that the forecasts are not sufficiently local and definite to be of any material service. While such a statement is hardly borne out by the experience of others, there can be little doubt that the adoption of the suggestion of the Royal Sanitary Institute would enhance the value of the forecasts.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

AN OPTICAL PHENOMENON.

In case any communications from other quarters have reached you in regard to the unusual appearance observed here on the 28th ult., and reported to the Meteorological Office, I am sending a note of it. What we saw was a practically complete parhelion circle with no halo and no parhelia. I first saw it when the sun was on the meridian, and the diameter of the circle about 60°. It remained generally visible for half an hour, though broken by clouds. Sighting observations and measurements confirmed the conclusion that it was a horizontal circle through the sun, and as the sun declined from the meridian the diameter increased appreciably. It was as bright as any solar halo I had ever seen.

WALTER W. BRYANT.

Royal Observatory, Greenwich, S.E., June 8th, 1912.

THUNDERSTORM FREQUENCY.

I was talking to a gentleman the other day about thunderstorms, and he said that the worst storms occurred in the lower Thames Valley, and that they were more frequent over that area than any other part of England. It would be very interesting to have the opinions of your readers, who are more learned in meteorology than I am.

G.E.D.

Lewisham, S.E.

WATERSHEDS.

May I call your readers' attention to the Dane, which is, through the Weaver, a tributary of the Mersey.

About two miles above Rushton (Staffs.) there is a flood weir, and water passing over this passes by a "feeder" to Rudyard Lake, and thence, when the lake is overflowing, by the Churnet to the Trent. Is there any other instance known of the water of a stream feeding both the North and the Irish Seas?

The river, at the point where the weir is situated, itself forms the Cheshire-Staffordshire county boundary. The coincidence of river-bed, watershed and county boundary is almost certainly unique.

JUVENIS.

Congleton.

ON DATING TEMPERATURE OBSERVATIONS.

THE subject of Mr. Wardale's communication in the March number of this Magazine has long exercised my mind, but so far I have been unable to see how the inaccuracies mentioned are to be avoided, where observations of maximum and minimum temperatures are made only once daily. I think there can be no question about 9 a.m. being the most convenient hour for observations generally, and further that it is desirable that there should be uniformity in entering the observations read at that hour to the preceeding day. The instance stated by Mr. Wardale may occur on the termination of a frost two or three times in a winter, but it is possible that even though the maximum and minimum readings in any such case may both be wrong, the mean of the two may be nearly, if not quite, the same as the mean of observations taken twice daily, where the errors would not occur, and therefore the general averages would not be affected.

W. PIFFE BROWN.

Belgrave Road, Gloucester, April 1st, 1912.

MONTHLY EXTREME TEMPERATURES.

COMING across a set of Whitaker's Almanacs some time ago, where the monthly meteorological observations at the Royal Observatory, Greenwich, are annually published, I was curious to study the extremes of air temperature that have occurred in London in every month since 1890 to 1911, both inclusive, and to compute the average extreme heat and cold for each calendar month on the basis of the 22 years average. The result is :—

WINTER.	Av. extreme max.	Av. extreme min.	SPRING.	Av. extreme max.	Av. extreme min.
November ...	58·7	26·6	February.....	55·3	22·2
December ..	54·6	23·0	March	62·3	25·6
January	53·0	22·1	April	68·9	29·6

SUMMER.	Av. extreme max.	Av. extreme min.	AUTUMN.	Av. extreme max.	Av. extreme min.
May	78·3	33·9	August.....	84·5	45·3
June	82·4	41·1	September ...	80·0	38·4
July	85·3	45·8	October.....	68·5	31·4

It will be seen that owing to accumulated heat leaving the weaker sun less work to do, the first two months of autumn show higher figures than the first month of summer. Similarly, for an inverse reason, the first month of spring appears colder than the first month of winter. Some allowance, however, should be made for the circumstance that the first week in November, February, May and August belongs, according to the sun's altitude, to the season preceding that under which the whole months are tabulated.

L. C. W. BONACINA.

THE AURORA.

By F. W. Henkel.

Few meteorological phenomena are of greater interest and beauty than the apparition of a brilliant aurora, though it must be confessed that even yet too little is known as to the cause and development of these striking manifestations. Those who "are in populous cities pent" are rarely vouchsafed the sight of an aurora, though even in London and Paris at times such occurrences are by no means unknown, the notable aurorae of September 25th, 1909, seen in the evening after the "magnetic storm" which for some hours interrupted telegraphic communications in London, and the great displays of October 24th and 25th, 1870, seen not only from Paris but over the whole of Europe, being conspicuous examples. But though this is the case, a much greater number are only visible in more northern latitudes, whilst in the latitude of London an average of six aurorae annually may be expected, this number is increased to 50 for the northern parts of our islands and Scandinavia, and for the Faroe Islands, Novaya Zemlya and Labrador, not far short of 100 aurorae is the annual average. Further north the frequency of the aurora diminishes, far fewer being seen from central Greenland, Baffin's Bay, &c., than in regions considerably further to the south. The curve of maximum frequency for the northern hemisphere passes by the North Cape, the northern extremity of Novaya Zemlya and Cape Cheliuskin (Siberia), its course over America being across Hudson's Bay and Labrador, passing to the south of Greenland and Iceland. The name of aurora borealis, or Northern Lights (literally "northern dawn"), was at first given to this phenomenon since it was not known to exist in the southern hemisphere, but since the days of Don Antonio de Ulloa, who frequently observed polar aurorae during his voyage round Cape Horn in 1745, it has been known that they are probably of quite as common occurrence south of the Equator as in our own northern hemisphere. Thus the name of aurora borealis should in strictness be restricted to those seen in the northern hemisphere towards the north, those seen in the southern hemisphere round the south pole being consequently known as "aurorae australes," whilst the common term polar aurora may be indiscriminately applied to all.

Though presenting a great variety of appearances, the most usual form assumed by the aurora, as seen from European latitudes, is that of a number of streaks or streamers of various colours, most commonly white tinged with yellow, but sometimes rose carmine and green; these streamers issuing from every direction but converging towards the same point, usually north, but occasionally west or south. From its appearance near the horizon as a vague and diffuse light, not unlike the faint streaks seen before sunrise which announce the dawn, comes the name "aurora."

Whilst, as we have just said, aurorae present the most complex and varied forms, they may be roughly divided into two principal classes,

the one comprising such as are apparently motionless, whose various parts retain for some time the same relative positions and intensity, the other class consists of such as vary rapidly and continually in shape and brightness (Angot). The first class (motionless aurorae) is again sub-divided into (1) faint lights of ill defined shape, (2) lights in the form of patches, clouds and bands, (3) homogeneous circular or elliptical arcs touching the horizon at either extremity and having their summits nearly in the magnetic meridian. Three principal sub-divisions may likewise be made of the rapidly changing aurorae, the first comprising non-homogeneous arcs or arcs with rays, and the second a number of isolated rays at a greater or less distance from one another, whose directions converge towards a fixed point in the sky, sometimes forming a sort of crown or "glory" around it, and lastly, non-homogeneous bands of varying heights, sometimes folded over on themselves and then forming the "draped" aurorae, the most beautiful manifestations of the "Northern Lights." Though these various forms are most commonly found singly, yet they may sometimes co-exist in one and the same aurora.

It is a remarkable fact that aurora borealis and australis are often simultaneously visible, of course in different hemispheres. Angot says:—"Every time that an aurora (australis) was seen at Hobart Town an aurora borealis was observed in the northern hemisphere, or at least if it were daytime in Europe there were those important magnetic pertubations which accompany polar aurorae." All authorities are agreed that the *total* illumination produced even by the finest aurorae is inferior to that of the full moon, and rarely exceeds that of the moon in her first and last quarters. Stars of the first and second magnitudes may be discerned through the brightest aurora, and fainter stars through more diffuse forms. Examined by the polariscope it was early ascertained that the light given by the aurora is not due to reflection or refraction of other light, but an intrinsic phenomenon, and the spectroscope has later shown that this is due to luminous gases, not to liquid and solid particles. A small spectroscope applied to the aurora shows only one greenish-yellow line whose position is between the two lines D and E of the solar spectrum, but an instrument of higher dispersive power used in connection with a large telescope reveals the presence of thirteen or fourteen bright lines or bands, all of which, however, are not found in one and the same spectrum. Mr. E. C. Baly concludes that he has detected the spectral lines of krypton, one of the recently discovered gases in our atmosphere (a companion of argon and helium), amongst the auroral lines, and the majority of spectroscopists consider the general character of the auroral spectrum to resemble closely that of the electric discharge through dry rarefied air.

It is still an open question whether any sound accompanies an auroral display. Many trustworthy observers vouch for its reality, others of equal eminence pronounce against it. It has even been

suggested that the faint whistling or rustling sound heard by some may have been a purely subjective phenomenon.

With regard to the height of the auroral beams above the surface of the ground, the general result of observations shows that the lowest parts have rarely a less altitude than 50 to 60 miles, whilst the upper parts may be as much as 500 miles high.

Others are at a much lower level, perhaps only at a few hundred feet from the ground. The practical difficulty of simultaneous measurements, from the same point, of so rapidly varying and sometimes ill-defined an appearance renders all numbers referring to auroral heights liable to considerable uncertainty. From comparison of his own observations with those of other Arctic explorers, Nordenskiöld considers it possible to explain the principal appearances by the hypothesis of a luminous ring encircling the earth almost continually, the plane of this ring being perpendicular to a radius of the earth passing through its surface in latitude 80° N. and longitude 81° W. This "aurora glory" is supposed to have a radius of about 2,000 kilometres (over 1,200 miles), and its height above those points where it lies in the zenith, about 200 kilometres. Though this hypothesis accounts satisfactorily for some of the phenomena, there are difficulties in accepting it in its entirety. Lemström has shown that the same appearance would be produced by a luminous arc of only 120 kilometres wide whose height was 12 kilometres, and this hypothesis of a permanent aurora gives no account of the undoubted variations in periodicity which next come in for our consideration.

Observations made in all countries have shown that the aurora has a tendency to manifest itself at certain hours of the night rather than at others. Thus the mean hour at which the aurora appears of maximum brightness seems to grow later as the latitude increases, from 8.45 p.m. at Prague (latitude 50°), 10 p.m. at Christiania (latitude 60°), midnight on Lake Athabasca, to 1.30 a.m. at Point Barrow (latitude 70°). It is, of course, not possible to determine the hour of minimum brilliancy, since the aurora is not visible by daytime, except during the winter in the Arctic regions. Observations made at Spitsbergen gave two maxima, one at 10.30 p.m., the other at 4.30 a.m., with an intervening minimum at 1.30 a.m. Tromholt has suggested that these diurnal variations might be due to a displacement of the zone of maximum frequency, southwards and northwards, in a period of twenty-four hours, but there are substantial objections to this view.

An annual periodicity seems fairly well established, though the difficulty of disentangling such a period is considerable, owing to the great variability in the length of the day in high latitudes, for during the time of perpetual day or when the sun is never more than a few degrees below the horizon, no aurorae can be seen at all, whilst during the long winter nights the possibilities of observation are greatly increased. Nevertheless it seems fairly well established

that aurorae are more frequent shortly after the equinoxes in April and October, and rarer in January and June. Since the winter minimum occurs just at the time most favourable for observation, there seems no reason for doubting its reality.

But perhaps the most interesting of the relations which are suggested is the following. One of the earliest discoveries of the telescope was that of the existence of dark markings or "spots" upon the sun, the central body of our system. These spots vary not only in size and shape, but yet more in their number upon the solar surface. About the middle of the seventeenth century scarcely any spots were seen at all, but the number visible from year to year underwent continual variation. Though a periodicity was long suspected, it was not definitely proved till 1851, when Schwabe of Dessau showed that about every eleven years or so the spots were vastly more numerous than at other times. Further researches have confirmed his results, giving an *average* interval of 11·1 years from maximum to maximum, or from minimum to minimum. The *actual* intervals between successive maxima, however, vary from 8 to perhaps nearly 16 years, and it has been suggested by Schuster and others that there is evidence of other periods of smaller and greater length than the eleven year period. The earlier observers of the aurora noticed similar variations in the occasions of the renewal of this phenomenon, and Mairan, in 1733, even suggested a possible connection between the two.

Not long after Schwabe's definite detection of the eleven year period of sunspots (and possibility of general solar activity also) Sabine and others showed that the variations in magnetic declination and intensity were subject to the same periodicity and had the same dates of maxima and minima. Fritz and Lovering, as well as the late Elias Loomis, showed that the number and importance of the aurorae follow the same law as sunspots, and that epochs of maxima and minima coincide almost exactly, as had been suspected by Mairan more than a century before. There are, however, certain discrepancies in detail. The irregular variations known as "magnetic storms," when the compass needle makes oscillations of 5° or even 10° within an hour or two (Young) are almost invariably accompanied by an aurora, and these follow, sometimes within a few hours, the appearance of unusual disturbances on the solar surface, such as the projection of vast luminous jets, prominences and great sunspots.

A connection has also been suspected between the frequency of the aurora and the solar rotation period (27 days), or possibly the moon's period of revolution, but the mention of it must here suffice. The *fact* of a connection of some kind between solar phenomena (not necessarily sunspots) and auroral and terrestrial magnetism generally seems beyond dispute, but the true nature of the connection, which is cause and which effect, or whether all are due to a common unknown cause, is a matter as to which much further investigation and less fanciful theories are greatly to be desired.

REVIEWS.

Meteorological Instruments and Weather Forecasts. Simply explained by H. T. DAVIDGE, B.Sc., M.I.E.E.. The Model Engineers' Series, No. 16. London, Percival Marshall & Co. Size $7\frac{1}{2} \times 5$. Pp. 92. Price 6d. net.

THE author is obviously not a meteorologist, and the meteorological introduction is not always accurate. The trade-winds are described as "blowing at certain times of the year between certain parallels of latitude," whereas they blow all the year round, though their margins reach a little further north or south at certain seasons. Again the saturation point of air is said to be affected by pressure. This is not so; a reduction of pressure leads to reduction of temperature by expansion, and the lowered temperature leads to saturation. It is scarcely correct to say that the Centigrade thermometer is "used for scientific purposes always," for most meteorological investigations in English speaking countries are carried out with the Fahrenheit scale. It is very misleading to show a Six's thermometer as the only example of maximum or minimum thermometer; such an instrument is never used in meteorological stations in this country. The rain gauge figured is the Glaisher pattern, while that described is the Meteorological Office pattern. It is a mistake to say that "the most favoured size now is the 8-inch gauge;" there are certainly ten 5-inch gauges in use for every 8-inch gauge. The only recording rain gauge described is one of the worst, the tipping-bucket pattern. Several pages are devoted to sun-dials, which are interesting instruments, but not meteorological. In the section on weather forecasts, the old drum and cone signals are figured with no indication that cones alone are now employed. The little book could be made useful by revision, and some notice of the Bradford rain gauge, which is that most used by Water Engineers, might appear.

The Structure of the Atmosphere in Clear Weather, and study of soundings with pilot balloons. By C. J. P. CAVE, M.A. Cambridge, University Press, 1912. Size $11 \times 8\frac{1}{2}$. Pp. xii. + 144.

MR. CAVE presents us in this volume with the results of 200 pilot balloon ascents from Ditcham Park on the South Downs. In some cases the balloons when released were followed by one or two theodolites, and their path determined in altitude and azimuth; in other cases the balloons were set free with a label, which was returned to Mr. Cave when picked up after the balloon had burst. The method of working is fully described and discussed, with tables for all ascents, and diagrams are given for about 50 cases, showing the variation of wind velocity and direction deduced from the movements of the balloons from the ground up to the maximum height attained, which was sometimes as much as 18 kilometres on about 11 miles. The

variation of the wind with height is treated in detail, with photographs of models which give a very graphic representation, and a valuable Introduction explains the phenomena in a simpler manner than that employed in the text. On several occasions the observations were continued well into the region which has usually in England been called the isothermal layer, but which, we are glad to see, Mr. Cave calls the stratosphere. The following quotation from the Introduction gives a brief statement of the varieties of structure in the atmosphere which have been observed, and Mr. Cave is to be congratulated on the fine results of the series of difficult experiments which he has carried out with the greatest skill and success. "Five types are described: (*a*) wind in the upper air steady with no increase in velocity with height; (*b*) wind in the upper air increasing, sometimes to several times the gradient value, but remaining more or less steady in direction; (*c*) wind in the upper air decreasing in velocity; (*d*) reversals or great changes in wind direction in the upper air; (*e*) wind in the upper air blowing away from centres of low pressure. In the types represented by these five classes, the wind in the upper air has been compared with that on the surface. A consideration of the higher ascents has shown that the strongest current is, as a rule, to be found in the region just below the stratosphere. This rapidly moving current must be associated with a corresponding pressure distribution in that region. Recent researches have tended to show that it is there that changes of pressure originate, and from this point of view, the layer just below the stratosphere must be regarded as controlling the conditions throughout the atmosphere beneath."

Science of the Sea, an elementary handbook of practical Oceanography for travellers, sailors and yachtsmen, prepared by the Challenger Society for the promotion of the study of Oceanography. Edited by G. Herbert Fowler, B.A., Ph.D., F.L.S., &c. With illustrations and charts. London: John Murray, 1912. Size, 8 × 5. Pp. xviii. + 452.

The growing recognition of the intimate relationship between meteorology and oceanography, the sciences of the two fluid envelopes of the Earth, will make this volume interesting to many of our readers. It consists of thirteen chapters by different authors, Chapter I., "The Air," being written by Dr. H. R. Mill and Captain D. Wilson-Barker, and Chapter II., "The Water," by Dr. H. N. Dickson and Mr. D. J. Matthews. Chapter VI., "The Sea Floor," is by Sir John Murray, and other chapters deal with shore-collecting, marine plants, animals, dredging and trawling, yacht equipment, etc., by various practical workers in the special departments. In addition to much supplementary matter, the Editor supplies valuable tables and lists of literature, as well as a classified list of firms supplying the various articles of equipment.

RAINFALL TABLE FOR JUNE, 1912.

STATION.	COUNTY.	Lat. N.	Long. W. [*E.]	Height above Sea. ft.	RAINFALL OF MONTH. Aver. 1875—1909. in.	1912. in.
		° ′	° ′			
Camden Square	*London*	51 32	0 8	111	2·28	3·23
Tenterden	*Kent*	51 4	*0 41	190	2·03	3·33
Arundel (Patching)	*Sussex*	50 51	0 27	130	2·13	3·27
Fawley (Cadland)	*Hampshire*	50 50	1 22	52	2·17	3·36
Oxford (Magdalen College)	*Oxfordshire*	51 45	1 15	186	2·27	3·24
Wellingborough (Croyland Abbey)	*Northampton*	52 18	0 41	174	2·10	3·14
Shoeburyness	*Essex*	51 31	*0 48	13	1·77	1·85
Bury St. Edmunds (Westley)	*Suffolk*	52 15	*0 40	226	2·21	2·21
Geldeston [Beccles]	*Norfolk*	52 27	*1 31	38	1·77	2·70
Polapit Tamar [Launceston]	*Devon*	50 40	4 22	315	2·18	5·66
Rousdon [Lyme Regis]	,,	50 41	3 0	516	2·18	3·93
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	2·43	6·39
Church Stretton (Wolstaston)	*Shropshire*	52 35	2 48	800	2·59	4·30
Coventry (Kingswood)	*Warwickshire*	52 24	1 30	340	2·52	4·48
Boston	*Lincolnshire*	52 58	0 1	25	1·95	3·31
Worksop (Hodsock Priory)	*Nottinghamshire*	53 22	1 5	56	2·06	4·52
Macclesfield	*Cheshire*	53 15	2 7	501	2·85	3·90
Southport (Hesketh Park)	*Lancashire*	53 38	2 59	38	2·26	4·71
Arncliffe Vicarage	*Yorkshire, W.R.*	54 8	2 6	732	3·63	8·98
Wetherby (Ribston Hall)	,, ,,	53 59	1 24	130	2·17	4·73
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	2·09	4·89
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	2·04	5·08
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	6·94	10·88
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	2·55	7·51
Haverfordwest	*Pembroke*	51 48	4 58	95	2·74	5·94
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	2·97	5·78
Llandudno	*Carnarvon*	53 20	3 50	72	1·97	3·42
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	2·84	7·45
Marchmont House	*Berwick*	55 44	2 24	498	2·38	5·00
Girvan (Pinmore)	*Ayr*	55 10	4 49	207	3·04	5·88
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	2·41	4·64
Inveraray (Newtown)	*Argyll*	56 14	5 4	17	3·64	4·87
Mull (Quinish)	,,	56 34	6 13	35	3·30	5·08
Dundee (Eastern Necropolis)	*Forfar*	56 28	2 57	199	2·06	3·22
Braemar	*Aberdeen*	57 0	3 24	1114	2·18	2·67
Aberdeen (Cranford)	,,	57 8	2 7	120	2·02	2·30
Cawdor	*Nairn*	57 31	3 57	250	2·13	3·72
Fort Augustus (S. Benedict's)	*E. Inverness*	57 9	4 41	68	2·07	3·76
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	4·07	4·34
Dunrobin Castle	*Sutherland*	57 59	3 56	14	2·10	2·74
Wick	*Caithness*	58 26	3 6	77	1·83	·90
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	2·92	7·04
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	2·79	5·20
Nenagh (Castle Lough)	*Tipperary*	52 54	8 24	120	2·70	5·96
Miltown Malbay	*Clare*	52 52	9 26	400	3·12	7·23
Gorey (Courtown House)	*Wexford*	52 40	6 13	80	2·59	5·01
Abbey Leix (Blandsfort)	*Queen's County*	52 56	7 17	532	2·58	5·12
Dublin (Fitz William Square)	*Dublin*	53 21	6 14	54	2·00	2·60
Mullingar (Belvedere)	*Westmeath*	53 29	7 22	367	2·72	5·42
Cong (The Glebe)	*Mayo*	53 33	9 16	112	3·18	5·96
Crossmolina (Enniscoe)	*Mayo*	54 4	9 16	74	3·17	4·31
Collooney (Markree Obsy.)	*Sligo*	54 11	8 27	127	3·11	5·51
Seaforde	*Down*	54 19	5 50	180	2·88	5·85
Bushmills (Dundarave)	*Antrim*	55 12	6 30	162	2·56	4·82
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	2·82	5·94

RAINFALL TABLE FOR JUNE, 1912—*continued.*

RAINFALL OF MONTH (*con.*)					RAINFALL FROM JAN. 1.					
Diff. from Av. in.	% of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days	Aver. 1875—1909. in.	1912. in.	Diff. from Aver. in.	% of Av.	Mean Annual 1875-1909. in.	STATION.
+ ·95	142	·68	7	19	10·96	12·98	+2·02	118	25·11	Camden Square
+1·30	164	·78	15	17	11·44	12·99	+1·55	113	27·64	Tenterden
+1·14	153	·67	4	14	12·46	16·02	+3·56	129	30·48	Patching
+1·19	155	·72	7	20	13·31	15·86	+2·55	119	31·87	Cadland
+ ·97	143	·67	7	20	10·60	14·49	+3·89	137	24·58	Oxford
+1·04	149	·64	7	21	11·14	11·98	+ ·84	108	25·17	Croyland Abbey
+ ·08	105	·48	15	13	8·00	8·28	+ ·28	103	19·28	Shoeburyness
·00	100	·48	3	16	10·76	10·65	— ·11	99	25·40	Westley
+ ·93	152	·43	3	17	9·61	9·42	— ·21	98	23·73	Geldeston
+3·48	259	·84	15	22	15·88	22·04	+6·16	139	38·27	Polapit Tamar
+1·75	180	·99	7	19	14·33	19·48	+5·15	136	33·54	Rousdon
+3·96	263	1·01	4	26	13·08	19·93	+6·85	152	29·81	Stroud
+1·71	166	·64	1	20	14·30	18·10	+3·80	127	32·41	Wolstaston
+1·96	178	·96	25	23	12·75	18·72	+5·97	147	28·98	Coventry
+1·36	170	·37	30	23	9·86	11·61	+1·75	118	23·35	Boston
+2·46	220	·53	2	24	10·80	15·35	+4·55	142	24·46	Hodsock Priory
+1·05	137	·45	14	26	14·76	14·98	+ ·22	101	34·73	Macclesfield
+2·45	209	1·07	17	23	12·96	17·27	+4·31	133	32·70	Southport
+5·35	247	1·03	27	26	27·22	35·42	+8·20	130	61·49	Arncliffe
+2·56	218	·88	3	21	11·63	18·15	+6·52	156	26·87	Ribston Hall
+2·80	234	·69	3	25	11·08	15·00	+3·92	135	26·42	Hull
+3·04	248	·93	3	23	11·55	15·43	+3·88	134	27·94	Newcastle
+3·94	157	1·40	18	29	56·38	60·04	+3·66	106	129·48	Seathwaite
+4·96	295	·80	2	25	17·22	25·43	+8·21	148	42·28	Cardiff
+3·20	217	1·56	27	21	19·45	26·13	+6·68	134	46·81	Haverfordwest
+2·81	194	1·41	17	20	18·12	22·37	+4·25	123	45·46	Gogerddan
+1·45	174	·60	17	22	12·37	12·80	+ ·43	103	30·36	Llandudno
+4·61	263	1·09	3	26	19·06	24·52	+5·46	129	43·47	Cargen
+2·62	210	·60	15	25	14·38	14·68	+ ·30	102	33·76	Marchmont
+2·84	193	·60	22	27	21·10	26·22	+5·12	124	49·77	Girvan
+2·23	193	·58	28	24	15·51	16·10	+ ·59	104	35·97	Glasgow
+1·23	134	1·00	21	26	29·32	32·14	+2·82	110	68·67	Inveraray
+1·78	154	1·22	21	22	23·55	23·47	— ·08	100	56·57	Quinish
+1·16	156	·37	27	25	12·02	11·86	— ·16	99	28·64	Dundee
+ ·49	122	...	...	...	15·15	16·05	+ ·90	106	34·93	Braemar
+ ·28	114	·56	13	25	14·02	13·95	— ·07	99	32·73	Aberdeen
1·59	175	1·11	30	19	12·51	11·20	—1·31	90	29·33	Cawdor
+1·69	182	·48	11	26	20·22	18·93	—1·29	94	44·53	Fort Augustus
+ ·27	107	·60	2	19	37·55	34·87	—2·68	93	83·93	Bendamph
+ ·64	130	·51	19	15	14·28	13·69	— ·59	96	31·90	Dunrobin Castle
— ·93	49	·14	11	17	12·71	13·62	+ ·91	107	29·88	Wick
+4·12	242	1·02	17	25	24·87	28·83	+3·96	116	54·81	Killarney
+2·41	186	·87	21	18	17·40	22·17	+4·77	128	39·57	Waterford
+3·26	221	1·01	17	23	17·51	20·20	+2·69	115	39·43	Castle Lough
+4·11	232	1·16	17	25	18·71	24·02	+5·31	128	45·11	Miltown Malbay
+2·42	193	·68	27	18	15·42	22·89	+7·47	148	34·99	Courtown Ho.
+2·54	198	·60	17	28	15·84	18·47	+2·63	117	35·92	Abbey Leix
+ ·60	130	·26	2	23	12·15	13·76	+1·61	113	27·68	Dublin
+2·70	200	·68	27	27	16·01	20·42	+4·41	127	36·15	Mullingar
+2·78	187	1·05	22	24	21·41	22·61	+1·20	106	48·90	Cong
+1·14	136	·61	9	21	23·38	23·22	— ·16	99	52·87	Enniscoe
+2·40	177	·61	25	24	18·83	22·06	+3·23	117	42·71	Markree
+2·97	203	1·30	8	24	17·42	24·24	+6·82	139	38·91	Seaforde
+2·26	188	·70	12	21	15·49	17·80	+2·31	115	37·56	Dundarave
+3·12	211	·67	27	25	17·10	21·03	+3·93	123	29·38	Omagh

SUPPLEMENTARY RAINFALL, JUNE, 1912.

Div.	STATION.	Rain inches	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road..	3·72	XI.	Lligwy	3·32
,,	Ramsgate	3·04	,,	Douglas	4·13
,,	Hailsham	3·55	XII.	Stoneykirk, Ardwell House...	6·30
,,	Totland Bay, Aston House...	3·77	,,	Dalry, The Old Garroch.....	7·46
,,	Stockbridge, Ashley..	4·61	,,	Langholm, Drove Road	4·93
,,	Grayshott	3·99	,,	Beattock, Kinnelhead	7·12
,,	Caversham, Rectory Road ...	3·47	XIII.	St. Mary's Loch, Cramilt Ldge	6·74
III.	Harrow Weald, Hill House...	2·33	,,	North Berwick Reservoir.....	3·09
,,	Pitsford, Sedgebrook...	2·62	,,	Edinburgh, Royal Observaty.	3·95
,,	Woburn, Milton Bryant.....	2·04	XIV.	Maybole, Knockdon Farm ...	4·13
,,	Chatteris, The Priory.....	5·14	XV.	Campbeltown, Witchburn ..	6·45
IV.	Colchester, Lexden	1·85	,,	Holy Loch, Ardnadam.....	8·15
,,	Newport.....	2·62	,,	Ballachulish House	6·21
,,	Ipswich, Copdock	2·46	,,	Islay, Eallabus	5·24
,,	Blakeney.....	3·99	,,	Tirie, Cornaigmore	5·11
,,	Swaffham	3·53	XVI.	Dollar Academy	4·85
V.	Bishops Cannings	3·42	,,	Balquhidder, Stronvar.....	8·06
,,	Winterbourne Steepleton.....	4·02	,,	Coupar Angus	2·96
,,	Ashburton, Druid House.....	6·13	,,	Glenlyon, Meggernie Castle..	4·94
,,	Cullompton	5·34	,,	Blair Athol	3·62
,,	Lynmouth, Rock House	7·33	,,	Montrose, Sunnyside Asylum.	1·31
,,	Okehampton, Oaklands.....	6·43	XVII.	Alford, Lynturk Manse	1·67
,,	Hartland Abbey.....	5·08	,,	Fyvie Castle	2·29
,,	Probus, Lamellyn.....	4·89	,,	Keith Station	2·75
,,	North Cadbury Rectory.....	4·43	XVIII.	Skye, Dunvegan	7·90
VI.	Clifton, Pembroke Road.....	4·76	,,	N. Uist, Lochmaddy	3·80
,,	Ross, The Graig	4·05	,,	Glenquoich, Loan.....	6·60
,,	Shifnal, Hatton Grange.....	5·43	,,	Alvey Manse.....	2·23
,,	Droitwich.....	5·75	,,	Loch Ness, Drumnadrochit...	5·70
,,	Blockley, Upton Wold.....	5·51	,,	Glencarron Lodge	4·63
VII.	Market Overton.....	5·07	XIX.	Invershin	3·51
,,	Market Rasen.....	4·84	,,	Loch Stack, Ardchullin	2·69
,,	Bawtry, Hesley Hall	4·57	,,	Melvich	2·11
,,	Derby, Midland Railway.....	5·22	XX.	Skibbereen Rectory	6·24
,,	Buxton	4·19	,,	Dunmanway, The Rectory ..	7·59
VIII.	Nantwich, Dorfold Hall	3·11	,,	Glanmire, Lota Lodge.....	4·69
,,	Chatburn, Middlewood	6·66	,,	Mitchelstown Castle.....	6·27
,,	Cartmel, Flookburgh	5·27	,,	Darrynane Abbey.....	8·43
IX.	Langsett Moor, Up. Midhope	3·87	,,	Clonmel, Bruce Villa	4·34
,,	Scarborough, Scalby	4·07	,,	Newmarket-on-Fergus, Fenloe	6·76
,,	Ingleby Greenhow	4·07	XXI.	Laragh, Glendalough	6·80
,,	Mickleton	6·10	,,	Ballycumber, Moorock Lodge	4·64
X	Bellingham, High Green Manor	5·47	,,	Balbriggan, Ardgillan	3·58
,,	Ilderton, Lilburn Cottage ...	5·22	XXII.	Woodlawn	5·75
,,	Keswick, The Bank.....	5·64	,,	Westport, St. Helens	5·53
XI.	Llanfrechfa Grange	8·27	,,	Achill Island, Dugort	5·60
,,	Treherbert, Tyn-y-waun	9·40	,,	Mohill, The Rectory	4·29
,,	Carmarthen, The Friary	5·84	XXIII.	Enniskillen, Portora.....	4·38
,,	Castle Malgwyn [Llechryd]...	4·94	,,	Dartrey [Cootehill]	4·51
,,	Crickhowell, Tal-y-maes.....	5·60	,,	Warrenpoint, Manor House ..	5·03
,,	New Radnor, Ednol	2·98	,,	Banbridge, Milltown	6·25
,,	Rhayader, Tyrmynydd	6·14	,,	Belfast, Cave Hill Road	7·17
,,	Lake Vyrnwy	4·91	,,	Glenarm Castle.....	6·10
,,	Llangyhanfal, Plâs Draw.....	4·31	,,	Londonderry, Creggan Res...	7·35
,,	Dolgelly, Bryntirion.....	7·92	,,	Killybegs	6·49
,,	Bettws-y-Coed, Tyn-y-bryn...	5·83	,,	Horn Head	5·39

METEOROLOGICAL NOTES ON JUNE, 1912.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow; F for number of days Frost in Screen; f on Grass.

LONDON, CAMDEN SQUARE.—The weather in the first half was of a dull, cool and showery nature generally, relieved by some fine sunny intervals. The latter half was finer and with seasonable temp. Duration of sunshine 172·5* hours, and of R 54·2 hours. Mean temp. 60°·2, or 0°·1 above the average. Evaporation 2·49 in. Shade max. 83°·4 on 19th; min. 44°·7 on 3rd. F 0, f 0.

TENTERDEN.—Duration of sunshine 225·0† hours. Only two days with temp. over 70°. Shade max. 81°·0 on 19th; min. 45°·0 on 3 days. F 0, f 0.

TOTLAND BAY.—The wettest June in 26 years record. Duration of sunshine 209·3* hours. Shade max. 72°·3 on 22nd, min. 45°·8 on 3rd. F 0, f 0.

PITSFORD.—R ·67 above the average. Mean temp. 57°·4. Shade max. 80°·5 on 22nd; min. 39°·4 on 11th.

IPSWICH, COPDOCK.—Duration of sunshine 196·9† hours. Mean temp. 59°·0. Shade max. 80°·0 on 22nd; min. 44°·9 on 2nd. F 0, f 0.

WINTERBOURNE STEEPLETON.—Wet and cold with the exception of the third week. Shade max. 70°·6 on 22nd; min. 38°·4 on 6th. F 0, f 1.

WOLSTASTON.—Wet on the whole, with cold nights, and occasional T and L. Shade max. 70°.5 on 22nd; min. 43°·0 on 1st.

HODSOCK PRIORY.—The wettest June for at least 37 years. Shade max. 78°·0 on 22nd; min. 38°·5 on 7th. F 0, f 0.

SOUTHPORT.—Duration of sunshine 163·3* hours or 55·0 hours below the average. Duration of R 71·8 hours. Evaporation 2·91 in. Mean temp. 56°·5 or 0°·2 below the average. Shade max. 73°·0 on 19th; min. 44°·0 on 1st and 11th. F 0, f 0.

LILBURN COTTAGE.—A rainy and sunless month. Much T at a distance but none locally. Grass and grain crops have benefited, but too much R for turnips and other field and garden crops.

HAVERFORDWEST.—Cold and wet. Crops backward but promise well. Duration of sunshine 192·7* hours. Shade max. 64°·2 on 12th; min. 37°·0 on 5th.

BETTWS-Y-COED.—The wettest June here since records have been kept. More sunshine than in June, 1907, when the R was 5·15 in. Shade max. 70°·0 on 12th and 22nd; min. 38°·0 on 5th. F 0, f 0.

CARGEN.—The bar. never touched 30 inches, and the mean reading was the lowest since 1860. Shade max. 68°·0 on 12th; min. 44°·0 on 12th.

EDINBURGH.—Shade max. 66°·6 on 23rd; min. 42°·2 on 17th. F 0, f 0.

INVERARAY.—The whole month was cold for June, and after the first week very unsettled with constant showers, but not without some sunshine.

COUPAR ANGUS.—A cold and sunless month. Almost daily light R up to 27th, after which, and following a TS, the R was excessive. Bar. was never below 29·5 inches, and never exceeded 30 inches. Shade max 71°·0 on 23rd; min. 35°·5 on 17th. F 0, f 0.

FORT AUGUSTUS.– Shade max. 69°·2 on 23rd; min. 37°·5 on 17th.

LOCH STACK.—Duration of sunshine, 91·7* hours.

GLANMIRE.—A wild unsettled month. Much damage was done to tender vegetation on the morning of 4th by frost. TSS with accompanying R and H were frequent from 5th to 9th.

CLONMEL.—The wettest June since 1900. Sunshine far below the average, no day being free from clouds. Shade max. 74°·0 on 12th; min. 34°·0 on 3rd.

DUBLIN.—A cloudy, rainy and cool month. The only fine weather coincided with a spell of E. winds from 5th to 12th. Mean temp. 57°·1, or 0°·8 above the average. Shade max. 68°·9 on 12th.; min. 45°·2 on 1st. F 0, f 0.

MARKREE.—Heavy R with frequent H showers and TSS, and a low temp. Small sunshine record. Shade max. 68°·0 on 22nd; min. 39°·0 on 12th and 16th. F 0, f 0.

WARRENPOINT.—Shade max. 64°·0 on 6th, 7th and 26th; min. 48°·0 on 11th and 16th. F 0, f 0.

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* Campbell-Stokes † Jordan.

Climatological Table for the British Empire, January, 1912.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity. 0-100	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
	°		°		°	°	°		°	°	inches		
London, Camden Square	51·7	6	17·7	29	44·2	36·1	38·0	91	66·4	16·2	4·08	17	8·6
Malta	65·7	9	46·5	2	60·2	52·7	49·2	81	125·8	..	3·84	17	6·2
Lagos	90·0	4	72·3	27	88·1	75·9	74·1	74	143·0	70·1	·64	1	...
Cape Town	100·8	10	51·0	23	79·6	59·5	60·8	67	...	...	·17	3	3·1
Durban, Natal ...	90·1	21	61·2	17	82·4	68·3	66·7	69	151·2	...	2·96	12	6·3
Johannesburg	87·3	27	49·6	17	79·8	57·8	56·4	74	150·8	46·8	2·83	10	5·5
Bloemfontein	98·8	2	46·5	16	89·3	62·9	55·5	54	...	...	1·01	6	4·5
Calcutta...	86·9	23	52·0	1	79·7	57·1	55·8	66	...	45·3	·00	0	2·0
Bombay...	92·1	26	64·5	12	85·2	69·6	65·0	68	137·2	56·9	·00	0	2·0
Madras	87·1	13	60·5	4	83·5	65·7	66·2	78	137·5	54·9	2·83	2	1·9
Kodaikanal	72·7	10	40·7	7	65·6	46·2	33·4	49	135·9	24·1	·70	4	2·0
Colombo, Ceylon ...	91·2	27	66·4	7	86·4	71·3	67·4	69	150·0	57·3	·75	6	3·4
Hongkong	72·3	6	46·0	30	60·2	54·5	51·4	79	122·0	...	2·71	13	9·1
Sydney	102·9	15	56·8	13	78·7	63·9	56·0	59	159·0	46·9	1·34	12	5·2
Melbourne	102·7	14	47·3	3	77·9	56·1	50·1	53	157·1	40·6	·47	5	3·9
Adelaide ...	109·8	31	49·3	3	85·9	59·8	51·8	46	162·8	38·4	·21	2	2·3
Perth	106·0	11	52·8	14	85·3	64·2	59·5	60	164·6	50·1	·12	2	3·1
Coolgardie	111·0	29	53·0	9	96·9	64·4	51·9	41	175·1	50·0	·18	3	2·2
Hobart, Tasmania ...	98·2	14	45·2	12	70·5	52·5	46·7	55	155·5	38·3	1·11	15	6·2
Wellington ...	76·0	7	48·2	5	66·2	54·4	50·1	69	122·0	38·0	1·00	11	6·7
Auckland	75·0	26	47·0	22	70·0	57·2	55·6	79	118·0	47·0	1·75	11	5·4
Jamaica, Kingston ..	91·0	6	64·4	6	87·5	68·8	68·6	77	...	...	1·40	...	...
Grenada	83·0	26	71·0	22	81·2	73·5	...	76	139·0	...	4·16	21	3·5
Toronto	38·5	18	—11·7	13	21·3	6·6	...	...	118·5	—20·6	2·97	18	6·6
Fredericton	46·5	19	—31·5	27	17·2	—2·9	...	83	...	...	3·10	10	5·4
St. John, N.B. ...	46·3	19	—12·7	13	21·4	5·4	...	...	...	...	3·08	15	5·3
Edmonton, Alta. ...	45·6	29	—40·8	10	13·7	—6·1	...	89	101·1	—46·0	·93	12	7·2
Victoria, B.C.	52·5	4	23·5	1	44·2	37·0	...	90	...	...	4·15	20	8·0

MALTA.—Mean temp. of air, 55°·8. Average bright sunshine, 4·9 hours per day.

Johannesburg.—Bright sunshine, 287·6 hours.

Bloemfontein.—Hot and dry, the heat very oppressive.

KODAIKANAL.—Bright sunshine, 279 hours. Hoar frost on 19 days.

COLOMBO.—Mean temp. of air 78°·9 or 0°·1 below, of dew point 2°·6 below, and R 2·66 in. below, averages. Mean hourly velocity of wind 8·8 miles. TS on 29th.

HONGKONG.—Mean temp. of air 57°·3, or 2°·8 below, R 1·25 in. above, averages. Bright sunshine 39·4 hours or 103·4 hours below average.

Sydney.—Mean temp. of air 0°·3 below, and R 2·29 in. below, averages.

Melbourne.—Mean temp. of air 0°·5 below, and R 1·38 in. below, averages.

Adelaide.—Mean temp. of air 1°·3, below, and R ·59 in. below, averages.

Perth.—Mean temp. of air 1°·3 above, and R slightly below, averages.

Wellington.—Mean temp. of air 2°·1 below, and R ·43 in. below, averages. Bright sunshine 226·9 hours.

Auckland.—Mean temp. of air much below average of previous 45 years.